Health Informatics Meets eHealth
G. Schreier and D. Hayn (Eds.)

doi:10.3233/978-1-61499-858-7-72

Facilitating the Information Exchange Using a Modular Electronic Discharge Summary

Kerstin DENECKE[a], Pascal A. DITTLI[a], Niveadha KANAGARASA[a], and Stephan NÜSSLI[a,1]
[a] *Bern University of Applied Sciences*

Abstract. *Background:* Discharge summaries are a standard communication tool delivering important clinical information from inpatient to ambulatory care. To ensure a high quality, correctness and completeness, the generation process is time consuming. It requires also contributions of multiple persons. This is problematic since the primary care provider needs the information from the discharge summary for continuing the intended treatment. To address this challenge, we developed a concept for exchanging a modular electronic discharge summary. *Methods:* Through a literature review and interviews with multiple stakeholders, we analysed existing processes and derived requirements for an improved communication of the discharge summary. *Results:* In this paper, we suggest a concept of a modular electronic discharge summary that is exchanged through the electronic patient dossier in CDA CH level 2 documents. Until 2020, all Swiss hospitals are obliged to connect to the electronic patient dossier. Our concept allows to access already completed modules of the discharge summary from the primary care side, before the entire report is entirely finalised. The data is automatically merged with the local patient record on the physician side and prepared for data integration into the practice information system. *Conclusion:* Our concept offers the opportunity not only to improve the information exchange between hospital and primary care, but it also provides a potential use case and demonstrates a benefit of the electronic patient dossier for primary care providers who are so far not obliged to connect to the patient dossier in Switzerland.

Keywords. Discharge summary, Medical documentation, Information exchange, Transition of care, Electronic patient record, Electronic health record

1. Introduction

The discharge summary is an important document used for information exchange in the transition from the hospital to primary care. It contains information on the patient's medical history, type, extent and results of the diagnostics and therapy measurements, the patient's prognosis and concrete recommendations for further treatment. It summarizes the course of disease and therapy. More specifically, the discharge summary is an essential source of information for the follow-up treatment. The recipients of the document such as rehabilitation clinics, general practitioners, physiotherapists or nursing houses have different information needs. Poor quality discharge summaries have been repeatedly demonstrated to lead to increased adverse events in patient care after discharge and to a need for re-hospitalization. Research has shown that there is a gap in

[1] Corresponding Author, Stephan Nüssli, Bern University of Applied Sciences, Höheweg 80, 2502 Biel, Switzerland, E-mail: Stephan.nuessli@bfh.ch.

the information chain after discharge from hospital [1]. Despite the ideal of a seamless handover, discharge summaries may not reach the general practitioner (GP) or may be compromised by significant delays, poor quality or illegibility [2]. However, a complete, accurate, and timely discharge summary can communicate important information to the GP, prevent adverse events, and reduce hospital readmission [3].

In this work, we are focusing on the GP and their needs with respect to the discharge summary for continuing the health monitoring and treatment of a patient discharged from a hospital. Since the discharge summary is also a legal document, the generation and signature process of the complete report is comprehensive and time consuming. The final report needs to be signed by the responsible hospital physician. At the same time, it is obvious that the GP needs the information immediately after discharge to continue the treatment appropriately. For this reason, a short summary with the most relevant information is currently sent right after discharge of the patient. However, this leads to double efforts since the GP has to check twice whether the data in his local patient record corresponds to the information from the discharge summary short report and final report. Another delay is caused by the paper-based format in which the report is currently transferred to the primary care provider.

A recent study in Germany demonstrated that the communication between hospital and primary care is mainly realised by standard mail. However, more than 35% of the primary care physicians and of the hospital physicians desire an exchange via secure E-mail. 40% of the hospital physicians would like to use an integrated information system [4]. To address these issues, we introduce the concept of a modular electronic discharge summary. Instead of sending unstructured PDF documents by E-Mail or printed by standard mail, reports will be available electronically and structured through the electronic patient record. With the adoption of the federal law on the electronic patient record in Switzerland, hospitals are obliged to join a certified community of patients until 2020. From then on, patients will have the opportunity to open an electronic patient record (EPD, electronic patient dossier) and access collected documents. The EPD is designed to create the technical prerequisites for healthcare professionals to have the relevant patient data at the right place at the right time. However Switzerland decided for an opt-in concept. That means that the participation is mandatory only for hospitals and nursing homes. For Patients and GPs the participation in the EPD is by choice. That is called “Doppelte Freiwilligkeit”. Therefore there must be a clear benefit for Patients and GPs to engage for the EPD.

As a result, GPs will be able to spend less time updating the patient's medical history and are able to focus more on their patients instead. In this paper, we identify the technical and semantic conditions that must be given to introduce a modular electronic discharge summary in Switzerland. In addition, a concept for the technical implementation is described. The basis of this work is the electronic patient record (ELGA) implemented in Austria, in which the reporting is already structured modularly.

2. Material and Methods

In this section, we summarize the methodology for concept generation and provide details on the eHealth initiative in Switzerland that concentrates on an electronic discharge summary.

2.1. Requirements collection

For concept generation, we collected requirements from a local GP and from the head of the medical informatics department of a hospital. More specifically, we collected information on the current procedure of information exchange between the hospital and the local physician in these two interviews. We also discussed our concept with them and considered the feedback for adapting the concept presented in this work.

Further, we talked to several companies that are distributing hospital information systems and discussed our concept with them. Another interview was held with a senior consultant of Triamed, a software producer that is developing information systems for primary care. That interview focused on possibilities to integrate a modular discharge summary into a practice information system (PIS).

2.2. IPAG and eAustrittsbericht

The "eAustrittsbericht" suggested in December 2015 by an inter-professional working group in Switzerland (IPAG) formulates recommendations for the interdisciplinary use of the information modules that are most important during treatment transitions [5]. These are to be used in electronic documents of the "Transition of Care" (eToC), i.e. transfers and treatment transitions, for inter-professional communication. These data modules can be used independently of each other in various documents such as discharge summaries. An eToC document consists of four main modules: "Problems", "Treatments", "Medication" and "Recommendations and other measures". eToC documents are intended for all processes in which one or more treatment transition takes place.

The contents of the respective modules can be structured or coded, but entering free text should always be possible. In the discharge summary, we can find different sections that contain data originating from the various professional groups. For example, the nurses summarize the nursing interventions and the health status of a patient as well as educations the patient received. Dietitians describe nutrition assessments and diagnosis as well as nutrition related treatments. For each module, the professional group must be included in the data entry so that it is clear from which area the information originates (e.g. laboratory, nursing, physician, radiology). The objective is to enable the use of subject-specific or occupational group-specific designations. Whenever possible, the SNOMED CT reference terminology should be used as a nomenclature for coding, and only if this is not possible, data should be coded with another classification system or ontology.

The type of transfer report or eToC document determines which modules should be included. This is implemented with predefined options. IPAG opted for the following options: "Mandatory", "Recommended", "Possible" and "Not applicable". If an entry is mandatory, a specification must be made (zero values are not possible) and if no information is available, it must be specified why the information does not exist.

2.3. HL7 CDA

Like DICOM, HL7 CDA is a standard used for healthcare communications. A CDA document is saved in XML (Extensible Markup Language) format. CDA documents can be structured according to three different levels. For CDA Level 1, only the header must be structured. The body contains unstructured textual information. It is also possible to

attach PDF files, TIFF images or other documents. In contrast, the body of a CDA Level 2 document must contain structured data so that the content can be recognized. In Level 2, however, it is also possible to enter unstructured data in the body. The Swiss healthcare system adopted the CDA standard by adding Swiss specific requirements. This resulted in the standard CDA-CH, which is used for the Swiss EPD. Meanwhile, the CDA-CH standard is already available in version 2 [6].

3. Results

In this section, we are describing our concept. We are focusing on the information exchange and information processing in hospitals and GPs. Hospitals have been chosen because they are legally obliged by the EPD law in Switzerland to join a certified community and participate in the EPD by 2020. GPs have been selected as a second stakeholder group because they are central to hospitals and the implementation of the EPD. The overall concept foresees a modular electronic discharge summary that is made available in the EPD and can be accessed and downloaded by the GP.

3.1. Requirements

Along with the discharge of a patient, two reports are generated. The short report and the final discharge summary differ mainly in scope and purpose. The short report is sent directly to the GP when the patient leaves the hospital and provides a rough overview of the most important key data such as diagnoses, allergies, procedures and medication. The final discharge summary additionally includes results of findings as well as follow-up documentation written by the resident physicians. The short report is usually only signed by the resident physician, but the final discharge summary contains a signature from the chief physician. Consequently, the concept of the electronic discharge summary therefore also requires a modular short report, unless the results of the downstream processes are sent separately.

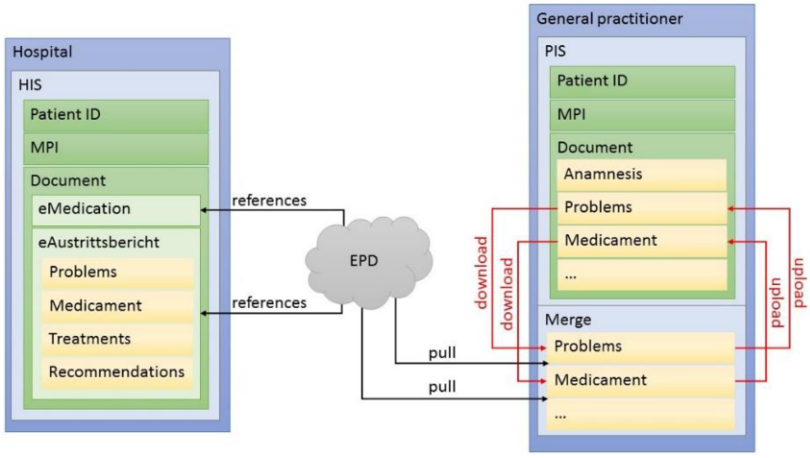

Figure 1. System architecture.

The data of the discharge summary should be made available through the EPD, thus, the information system has to be able to connect to the EPD. Data from the report should be stored locally in the patient record in the PIS. Interactions with the EPD and data updates in the PIS have to be logged in a logbook. A merging function is requested to see updates of the data such as medication data as reported in the discharge summary and to enable a comparison of the local data with the data from the report. Duplicates should be removed automatically. Redundant medications have to be made visible. The comparison has to be semantically, i.e. medications should be compared based on their active ingredients.

3.2. Modular structured discharge summary and its transfer

We introduce a modular electronic discharge summary. For each module of the modular electronic discharge summary, a status and the signature of the author for each module has to be assigned. In this way, the GP can see whether a module is already finalised or changes can still be made. Since the short report is usually targeted by the assistant doctor, the employment is included along with the signature. The head or chief physician is enabled to approve the final report at once, with the approval adopted for all modules. Signing individual modules requires that the different health professionals possess the necessary authorizations and work with their health professional ID. Once all modules are signed, the complete discharge summary can be imported by the GP.

On the primary care side, the access to the modular discharge summary is realized through a merging plugin in the PIS. In the background, the connection to the EPD is established and the data is loaded into the merge view. At the same time, the data is retrieved from the GP's patient record stored in the PIS. In addition, a copy of the original data from the EPD is stored in the local PIS. All executed actions are recorded and listed in a logbook.

The GP is informed as soon as all required modules contained in the discharge summary have been signed and approved. Afterwards, he can load the modules into the PIS and open the merge view. The data is retrieved from the referenced storage location as CDA-CH elements from the EPD according to the IHE profile XDS.b. In the merge view, the information contained in the patient record is compared to the information contained in the discharge summary pointing him to differences. After checking and confirming, the data in the PIS is updated. Figure 1 below illustrates the system architecture with the systems involved. The assumption is made that the GP's PIS is already connected to the EPD and thus modules from the hospital can be viewed directly.

PIS/Pat/Medication		Merge		KIS/Medication of Discharge	
Supplement	**Ingredient**	**Supplement**	**Ingredient**	**Supplement**	**Ingredient**
Beloc Zok	Metoprolol	Beloc Zok	Metoprolol	Dafalgan	Paracetamol
Norvasc	Amplodipin	~~Dafalgan~~	~~Paracetamol~~	Voltaren	Diclofenac
Sandoz	Paracetamol	Norvasc	Amplodipin	Beloc Zok	Metoprolol
Berocca	Vitamin B	Voltaren	Diclofenac	Norvasc	Amplodipin
		Sandoz	Paracetamol		
		Berocca	Vitamin B		

Figure 2. Merge view on the primary care provider side.

Figure 3. Signing of modules of the discharge summary.

Consider the following example: The medication is shown in the merge view (see figure 2). Duplicates are recognized and joined together during the joining process. For example, the drug Beloc Zok (Metoprolol) is only transferred to the merge view once, since it is present in the patient record and in the medication at discharge. If the two lists contain drugs with different names, but the same active ingredients, they are marked in red. Hospitals often use different medications than GPs, so it is quite possible that different medications with the same active ingredients may appear in the list. In this case, the GP can choose which medication he or she wants to have registered in the patient record. In green, the merge view shows the medications that were additionally distributed when the patient left the hospital. They can be integrated directly by the GP into his patient record after the checking.

4. Discussion

In this paper, we introduced a concept of a modular discharge summary that can be integrated into the eHealth environment of Switzerland. Switzerland's EPD is based on conceptual ideas similar to those of Austria. The Austrian health system has opted for an opt-out strategy, which means that an electronic patient record is created for all citizens by default. The ELGA portal offers the exchange formats eMedication and eBefund, which are used in the discharge summary. For a structured document, the Austrian HL7 group specified CDA, whereby the documents are subject to an XML structure. The CDA Release 2.0 is used, whereas Switzerland uses the same CDA with national components, namely CDA-CH V2. In the ELGA, eMedication and eBefund can be uploaded and managed on the portal. Through the portal, the patient can view his or her documents. From a technical point of view, CDA-CH allows the implementation of information modules, but it is recommended to use a CDA Level 2 structuring in which the body is also structured. The implementation of a national standard for the transmission of medical data would represent a milestone in terms of interoperability for the Swiss healthcare system. In this work, we did not design the concrete content of the CDA discharge document, but relied upon the general modular structure as suggested by the

inter-professional working group. Robust methods for reaching consensus among the relevant professional groups across all settings and all regions are paramount for the success of the introduced concept.

The idea of a modular discharge summary is not new. Paterson introduced their CDA-based structured discharge summary system in 2002 [7]. In Germany, the HL7 working group defined a structure for an eArztbrief (electronic discharge letter) [8]. It considers the developments in Austria and Switzerland. Physicians and physiotherapists can send an eArztbrief directly from the PIS. The data is transferred by a special secure mail provider. When incomplete letters are sent, this can be indicated by a status sign such as “preliminary”. Schabetsberger et al. developed and realized a strategy for a stepwise replacement of the paper-based transmission of medical documents with a distributed, shared medical record [9]. An electronic communication of discharge letters between existing information systems of different health care providers in Tyrol, Austria, has been established in the form of cryptographically signed S/MIME e-mail messages and, via a secure web portal system. Our work differs from this work by introducing a merge view that facilitates the integration of data for the GP and by directly integrating the EPD for data exchange instead of relying upon e-mail. Beyond, we did not focus on the HL7 CDA structure itself, but on how to use the components and integrated them into an eHealth environment.

An introduction to the use of modular discharge summary could be interesting for GPs because they would always be up to date in terms of information technology and could transfer the information directly from the modules to the patient's medical history. As many hospitals are competing with each other, the use of a modular discharge summary can make it easier for GPsto work together with a hospital and thus, should become an integral part of a hospitals' business strategy. In contrast to Austria, Switzerland has spoken in favour of an opt-in method, which means that patients have to make an effort on their own initiative to open a patient dossier. Due to this fact, Switzerland's electronic patient dossier must be convincing. Not only patients need to be convinced of the benefits of the EPDs, but also the GPswho have not yet been obligated to use the EPD by law. The future of the EPD therefore goes hand in hand with an added value for all, patients, hospitals and primary care provider.

Modular data exchange has the potential of shaping an interdisciplinary data flow. With the introduction of the EPD, reporting will also be revolutionized in a later phase. To be successful, the implementation of a modular exchange of discharge information needs to be coordinated by a central body such as eHealth-Suisse and the Federal Office of Public Health, since it involves all health professionals. The basic building block for implementing modular reports is the structuring of documents. Before a restructuring of the reporting system can be envisaged at national level, the large health care institutions must first be connected by the EPD and use the same exchange format.

As soon as reports can contain structured data and PIS can be connected to the EPD, the implementation of a merge view for general practitioners at the PIS manufacturers will be added to the roadmap. We hope that solutions such as the merge view will enable more physicians to be convinced of the benefits of electronic patient files in the future.

References

[1] C. Walraven, M. Taljaard, CM. Bell, E. Etchells, IG. Stiell, K. Zarnke, AJ. Forster. A prospective cohort study found that provider and information continuity was low after patient discharge from hospital. J Clin Epidemiol 2010;63:1000–10.

[2] S. Kripalani, F. LeFevre, CO. Phillips, et al. Deficits in communication and information transfer between hospital-based and primary care physicians: implications for patient safety and continuity of care. JAMA 2007;297:831–41

[3] C. Walraven, R. Seth. Effect of discharge summary availability during post-discharge visits on hospital readmission. J Gen Intern Med 2002;17:186–19.

[4] K. Obermann, P. Müller, S. Woerns (eds.): Ärzte im Zukunftsmarkt Gesundheit 2017 Transsektorale Zusammenarbeit. Eine deutschlandweite Befragung niedergelassener Ärztinnen und Ärzte. January 2018, https://www.stiftung-gesundheit.de/pdf/studien/Aerzte_im_Zukunftsmarkt_Gesundheit_2017.pdf

[5] D. Aronsky, E. Bättig, S. Bürki Sabbioni et al. 2. Bericht. Interprofessionelle Arbeitsgruppe Elektronisches Patientendossier. Arbeitsgruppe eAustrittsbericht. Bern, 2015, https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2016/D/160119_eAustrittsbericht_Bericht_IPAG_D.pdf

[6] J. Bleuer et al. CDA-CH-II: Spezifikation zum Erstellen von Vorlagen für die Health Level 7 Clinical Document Architecture. Version 1.2, HL7 Benutzergruppe Schweiz, 2011, https://www.hl7.ch/default/assets/File/Publikationen/CDA-CH-II_de_V1_2.pdf

[7] G.I. Paterson, M. Shepherd, Xiaoli Wang, C. Watters, D. Zitner: Using the XML-based Clinical Document Architecture for exchange of structured discharge summaries. System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii International Conference on. 2002

[8] KU. Heitmann, F. Oemig, D. Hellmuth, M. Aschhoff: Implementierungsleitfaden Arztbrief 2014/2015 (Implementation guide Letter to the doctor), final version, 15.10.2015, http://download.hl7.de/documents/cdar2-arztbrief/Arztbrief2014-v100.pdf

[9] T. Schabetsberger, E. Ammenwerth, S. Andreatta, et al. From a paper-based transmission of discharge summaries to electronic communication in health care regions. Int J Med Inform. 2006 Mar-Apr;75(3-4):209-15. Epub 2005 Aug 22.

[10] H.B. Bludau, A. Wolff, A.J. Hochlehnert, Presenting XML-based medical discharge letters according to CDA, Methods Inf. Med. 42 (5): 2003: 552—556